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EXAMINER

SONG, MATTHEW J

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1722

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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 09/425,694  
Filing Date: October 22, 1999  
Appellant(s): BRUNNER ET AL.

**MAILED**

NOV 03 2005

**GROUP 1700**

James Proscia  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 8/17/2005 appealing from the Office action mailed 9/17/2004.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

6,132,522	Verhaverbeke et al.	10-2000
EP 0 701 275 A2	Pirooz et al.	3-1996
5,014,737	Berman	5-1991

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pirooz et al (EP 0701275) in view of Verhaverbeke et al (US 6,132,522).

Pirooz et al teaches silicon wafers may be pre-cleaned by being immersed in a SC-1 cleaning solution, which contains about 1000:1:1 to 1:1:1 parts by volume  $\text{H}_2\text{O}:\text{H}_2\text{O}_2:\text{NH}_4\text{OH}$  and has a temperature of about 0-100°C (col 2, ln 30-47). Pirooz et al also teaches metal removal is carried out by immersing the silicon wafer in a bath of an aqueous solution containing about 1:1 to 1:10000 parts by volume  $\text{HF}:\text{H}_2\text{O}$  and to enhance metal removal, the solution may additionally contain  $\text{HCl}$ ,  $\text{H}_2\text{O}_2$  or ozone (col 2, ln 48-60), this reads on applicant's firstly treating the semiconductors in a bath of aqueous  $\text{HF}$  solution only containing  $\text{HF}$  and optionally containing  $\text{HCl}$  and optionally a surfactant. After the metal removal, the silicon wafers are rinsed in deionized water and the rinsed wafers are immersed in a bath containing a bout 0.1-50 ppm ozone at a temperature of about 0-60°C. Optionally, the ozonated water may additionally contain hydrochloric or nitric acid in a volume ratio ranging from about 1:1000 to 1:1 of acid:water (col 3, ln 1-35), this reads on applicant's treating the wafers in a bath with an aqueous  $\text{O}_3$  solution containing  $\text{O}_3$ . Pirooz et al also discloses the treated wafers should be rinsed in deionized water.

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The final step is drying the wafers by spin-drying and isopropyl alcohol vapor drying techniques (col 3, ln 35-50).

Pirooz et al does not teach treating the semiconductor wafers in a bath with an aqueous HCl solution only containing HCl and optionally O<sub>3</sub>.

In a method of wet processing electronic components, note entire reference, Verhaverbeke et al teaches a rinse fluid may be deionized (DI) water or a very dilute aqueous solution of a hydrochloric, hydrofluoric or ozone at a concentration not greater than 100 ppm to prevent metallic deposition on the surface of the electronic component precursors (col 5, ln 1-20). Verhaverbeke et al also teaches a sequential chemical process where electronic component precursors are moved from one reaction chamber to another, wherein each reaction chamber, bath, contains a different reactive chemical process fluid (col 5, ln 35-60 and col 5, ln 17-50). Verhaverbeke et al also teaches that certain baths may contain a rinse fluid but it is required that at least two of the baths in a sequence contain a reactive chemical (col 7, ln 60-67 and col 4, ln 1-10). Verhaverbeke et al also teaches hydrochloric acid, hydrofluoric and ozone are suitable reactive chemical process fluids (col 6, ln 35-60) and the method of sequential chemical processing is applicable to cleaning, stripping and/or etching wafers (col 3, ln 5-15). Verhaverbeke et al also teaches higher output of wafers and significant cost savings is achieved by eliminating the DI rinse between each chemical treatment step (col 4, ln 15-25).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Pirooz et al DI water rinsing step with Verhaverbeke et al's rinsing fluid of an aqueous solution of HCl in a bath to prevent metal deposition ('522 col 5, ln 5-15).

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Pirooz et al also does not teach these treatment steps form a treatment sequence, which avoids rinsing with water or another treatment liquid and the addition of fresh water or other liquids to the treatment baths.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Pirooz et al with Verhaverbeke's method of sequential chemical processing without rinsing to increase output and savings ('522 col 4, ln 15-25).

Referring to claims 1 and 11, the combination of Pirooz et al and Verhaverbeke et al teach a first treating a wafer in a bath of aqueous HF ('275 col 2, ln 48-60), treating in a bath of aqueous O<sub>3</sub> ('275 col 3, ln 14-35), then treating the wafers in a bath with an aqueous HCl solution ('275 col 3, ln 35-40 and col 5, ln 1-17), whereby these treatment steps avoid rinsing with water or another treatment liquid and the addition of fresh water or other liquids to the treatment baths ('522 col 3, ln 55 to col 4, ln 7). The combination of Pirooz et al and Verhaverbeke et al teach the HCl step is a rinsing step. However, this step reads on applicants' limitation of avoids rinsing, where rinsing is defined to be when a fresh treatment liquid is supplied continuously or at intervals on page 2 of the instant specification, because the HCl is in a bath and not supplied continuously or at an interval. Also, the HCl is at a similar concentration as disclosed by applicant.

Referring to claim 2, the combination of Pirooz et al and Verhaverbeke et al teach an SC-1 treatment ('275 col 2, ln 30-45).

Referring to claim 3, the combination of Pirooz et al and Verhaverbeke et al teach drying ('725 col 3, ln 40-50).

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Referring to claim 4, the combination of Pirooz et al and Verhaverbeke et al teach  $(B_1+B_2)+B_3$ , where m is 1.

Referring to claim 5, the combination of Pirooz et al and Verhaverbeke et al does not teach the HF concentration is 0.001-2% by weight. Concentration is well known in the art to be a result effective variable. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Pirooz et al and Verhaverbeke et al by conducting routine experimentation of a result effective variable to obtain same. Furthermore, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. (In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235(CCPA 1955)).

Referring to claim 6, the combination of Pirooz et al and Verhaverbeke et al teaches .1-50 ppm of ozone ('275 col 3, ln 25-30). Overlapping ranges is held to be obvious (MPEP 2144.05).

Referring to claim 7, the combination of Pirooz et al and Verhaverbeke et al teaches using ozone to prevent metal deposition ('522 col 5, ln 1-15).

Referring to claim 8, the combination of Pirooz et al and Verhaverbeke et al teach drying by using spin drying, this reads on applicant's centrifuging, and using isopropyl alcohol.

Referring to claim 9, the combination of Pirooz et al and Verhaverbeke et al teaches  $\text{NH}_4\text{OH}$  and  $\text{H}_2\text{O}_2$  ('275 col 2, ln 30-50).

Claims 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pirooz et al (EP 0701275) in view of Verhaverbeke et al (US 6,132,522) as applied to claims 1-9 and 11 above, and further in view of Berman (US 5,014,737) or Davison et al (US 5,593,538).

The combination of Pirooz et al and Verhaverbeke et al teach all of the limitations of claims 12-15, except the circulating of treatment liquids of the baths by taking a part from each of the baths, filtering and returning the part to the corresponding treatment bath.

In an apparatus for a recirculating chemical bath, note entire reference, Berman teaches a high purity chemical bath includes a process tank and a sump chamber disposed directly adjacent to the process tank. Berman also teaches the sump chamber includes a fitting in the bottom which directs liquid from the sump into a pump/filter circuit and the out of which is fed into the bottom of the process tank. The liquid is caused to overflow the process tank and flow into the sump chamber, this reads on applicants' taking part of the bath and filtering and returning the part to the bath (Abstract). Berman also teaches wafer etching and cleaning in the semiconductor industry require high levels of purity during processing and to reduce contaminating particulates various in-process recirculating filtering arrangements have evolved (col 1, ln 5-20). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Pirooz et al and Verhaverbeke et al by using the recirculating baths taught by Berman to reduce contaminating particulates in the bath and to extend the useful life of the bath.

In a method of etching a semiconductor, Davison et al teaches a recirculating bath of an etchant and recirculation of the etchant is established by overfilling the tub with the etchant and the portion of the etchant that overflows the tub is collected in a recirculating path, pumped through a filter and injected back into the tub (col 2, ln 30-60). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Pirooz et al and Verhaverbeke et al by using the recirculating baths taught by Davison et al to reduce contaminating particulates in the bath and to extend the useful life of the bath.

**(10) Response to Argument**

Independent claims 1 and 11 are rejected as being unpatentable over Pirooz et al (“Pirooz”) in view of Vebaverbeke et al (“Verhaverbeke”). Pirooz teaches a first step of removing metals using a HF solution (column 2, lines 48-55), a second step of rinsing in deionized water (“DI”) (column 3, lines 8-13), a third treatment step using ozonated water (“O<sub>3</sub>”) and hydrochloric acid (“HCl”) (column 3, lines 14-34), and a fourth-and-final step of rinsing with DI water (column 3, lines 35-41). Two modifications to Pirooz, which would have been obvious to a person of ordinary skill in the art at the time of invention in view of Verhaverbeke, are necessary to arrive at appellant’s invention. The first modification requires the elimination of the rinsing with deionized water in the second step. The second modification requires modifying the final step of rinsing with DI water to include HCl. Verhaverbeke teaches a sequential chemical process where electronic component precursors are continually exposed to reactive chemical process fluids without rinsing with DI (column 4, lines 14-23 and column 5, lines 39-57) and certain baths may contain a rinse fluid, but it is required that at least two of the baths in a sequence contain a reactive chemical process fluid (column 7, lines 50-67), which is why it would be obvious to remove the second step of rinsing with DI between the two reactive chemical treatments. Verhaverbeke also teaches a rinse fluid may be DI water or a very dilute aqueous solution of a hydrochloric acid to prevent metallic deposition on the surface of the electronic component (column 5, lines 1-17).

Appellant’s argument that Pirooz teaches away from the substitution of a DI water rinse with an aqueous HCl rinse is noted but is not found persuasive. Appellant alleges that Pirooz

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seeks to remove the residue of such acid containing solutions with deionized; therefore would not include an acid in the rinse solution, note page 6 of the Appeal Brief. The Examiner disagrees with this assertion because the hydrochloric acid in the DI rinse, taught by Verhaverbeke, is explicitly taught to contain HCl in a minute concentration and Verhaverbeke specifically teaches the primary goal of the rinsing fluid is to remove chemicals or reaction products from the surface of electronic components, and not to perform some “reactive process” (column 5, lines 1-17). The rinsing fluid still maintains its function of removing chemical from the electronic components because the HCl is only present in a minute concentration and specifically present in an amount, which is non-reactive. It is noted that as instantly claimed, a minute concentration HCl solution would read on appellant’s limitation requiring treating the semiconductor wafers in a bath with an aqueous HCl solution containing HCl and optionally O<sub>3</sub>, because there are no minimum concentration requirements. It is also noted appellant’s also teach an embodiment where the final treatment could be aqueous HCl or water (page 2, lines 1-3 of the specification), which suggests that appellant’s final aqueous HCl step also functions more as a rinse step.

Appellant’s argument that Verhaverbeke teaches sequential chemical processing limited only to the processes disclosed and not to all chemical process is noted but is not found persuasive (pages 7-8 of the appeal brief). Verhaverbeke specifically teaches, “process fluids suitable for these treatments include, **without limitation**, solutions of sulfuric acid with ozone ...” in column 6, lines 61-63 (emphasis added). Verhaverbeke does not limit his invention or teaching to any particular reactive fluids, as alleged by Appellant. Furthermore, the broad disclosure of Verhaverbeke teaches electronic components are moved from one reaction chamber

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to another, wherein each reaction chamber contains a different reactive chemical process fluid, note column 3, lines 57 to column 4, lines 6, which would suggest to a person of ordinary skill in the art that ozone would be applicable.

Appellant's argument that any attempt to combine the teaching of Pirooz with Verhaverbeke would destroy the teaching of Pirooz is noted but is not found persuasive. Appellant alleges that the wafers are contacted with ozone to produce a wafer having a hydrophilic oxide surface and any further treatment of the hydrophilic oxide would destroy the properties of the surface. As stated earlier in regards to the HCl rinse, Verhaverbeke explicitly teaches the concentration of HCl is minute and the primary goal of the rinsing fluid is to remove chemical from the surface, and not to perform some "reactive process". Modifying Pirooz with Verhaverbeke would not destroy the teachings of Pirooz, as suggested by Appellant, because the concentration of HCl is too minute and not sufficient in concentration to react with the hydrophilic surface in a detrimental way.

Appellant's argument that Berman will produce massive contamination of the treatment baths, leading to the high increase in LPD's for C1 and C2 as shown in the Table on page 5 of the specification is noted but is not found persuasive (page 11 of the appeal brief). It is unclear how Appellant arrived at a relationship to the results of the Table on page 5 and recirculation of a bath, as taught by Berman. The comparative examples on page 5 refer to rinsing with DI water, there is no mention of recirculation. Also, Berman teaches recirculation to remove contaminating particulates, note column 1, lines 7-17, which contradicts Appellant's allegation that the combination of the process tank of Pirooz with Berman will produce massive contamination of the treatment baths. There is no factual correlation with the teachings of Berman and the results

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in the Table of page 5 and there is no mention of recirculation/filtration, as taught by Berman, in the comparison of results in the Table. The same arguments apply to Davison et al because Davison et al also teaches a recirculation bath and there is no correlation between recirculating baths designed to filter the contents of a bath and the results in the Table on page 5 of the specifications.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Matthew Song



Conferees:

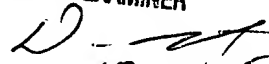


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